Micropower Dual Comparator

FEATURES

- Maximum Offset Voltage: 1mV
- Maximum Bias Current: 15nA
- Typical Output Drive: 70mA
- Operates from 1.1V to 40V
- Internal Pull-Up Current
- Output Can Drive Loads Above V^+
- 30μA Supply Current (LT1017)
  110μA Supply Current (LT1018)
- Available in 8-Lead PDIP, 8-Lead Plastic SO, and 16-Lead Plastic SO Packages

APPLICATIONS

- Power Supply Monitors
- Relay Driving
- Oscillators

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DESCRIPTION

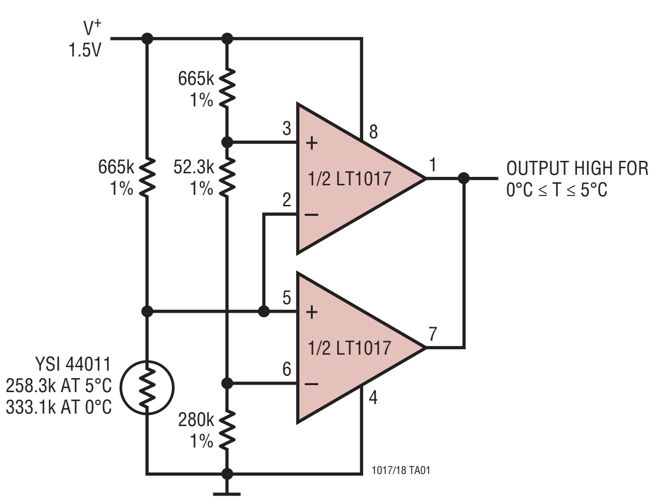
The LT®1017/LT1018 are general purpose micropower comparators. The LT1017 is optimized for lowest operating power while the LT1018 operates at higher power and higher speed. Both devices can operate from a single 1.1V cell up to 40V. The output stage includes a class "B" pull-up current source, eliminating the need for an external resistive pull-up and saving power. The output stage is also designed to allow driving loads connected to a supply more positive than the device, as can comparators with open-collector output stages.

Input specifications are also excellent. On-chip trimming minimizes offset voltage, while high gain and common mode rejection ratio keep other input referred errors low. Common mode voltage range includes ground. Special circuitry prevents false output states even if the input is overdriven.

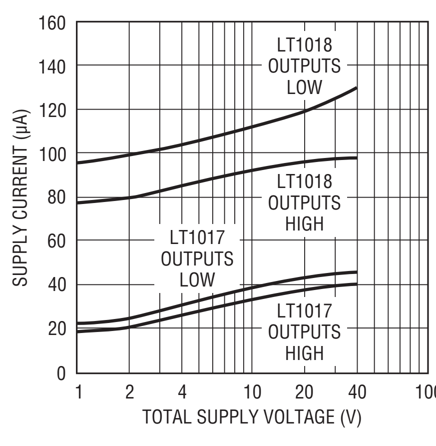
The LT1017/LT1018 are pin compatible with older dual comparators such as 393 type devices.

TYPICAL APPLICATION

1.5V Powered Refrigerator Alarm



Supply Current



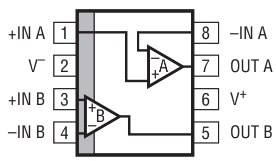
ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage 40V
Differential Input Voltage 40V
Input Voltage .... –0.3V to 40V
Short-Circuit Duration .... Indefinite
Storage Temperature Range .... –65°C to 150°C

Operating Temperature Range
LT1017M/LT1018M .... –55°C to 125°C
LT1017C/LT1018C .... 0°C to 70°C
LT1017I/LT1018I .... –40°C to 85°C
Lead Temperature (Soldering, 10 sec) .... 300°C

PACKAGE/ORDER INFORMATION

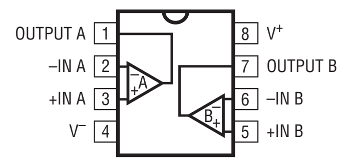
TOP VIEW



S8 PACKAGE
8-LEAD PLASTIC SO
T_{JMAX} = 150°C, θ_{JA} = 190°C/W

ORDER PART NUMBER	S8 PART MARKING
LT1017CS8	1017
LT1017IS8	1017I
LT1018CS8	1018
LT1018IS8	1018I

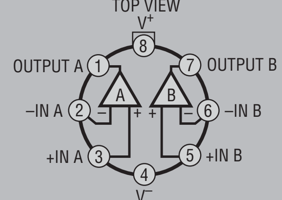
TOP VIEW



N8 PACKAGE
8-LEAD PDIP
T_{JMAX} = 150°C, θ_{JA} = 140°C/W

ORDER PART NUMBER	PART MARKING
LT1017CN8	
LT1017IN8	
LT1018CN8	

TOP VIEW



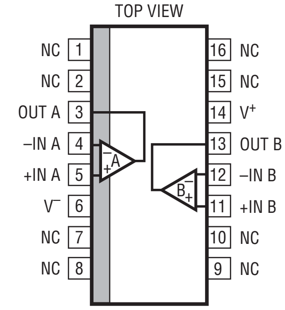
H PACKAGE
8-LEAD TO-5 METAL CAN
T_{JMAX} = 150°C, θ_{JA} = 150°C/W, θ_{JC} = 45°C/W

OBSOLETE PACKAGE

Consider the 8-Lead Plastic Dip Package For Alternate Source

ORDER PART NUMBER	PART MARKING
LT1017MH	
LT1017CH	
LT1018MH	
LT1018CH	

TOP VIEW



SW PACKAGE
16-LEAD PLASTIC SO
T_{JMAX} = 150°C, θ_{JA} = 130°C/W

ORDER PART NUMBER	PART MARKING
LT1017CSW	
LT1018CSW	

Order Options Tape and Reel: Add #TR
Lead Free: Add #PBF Lead Free Tape and Reel: Add #TRPBF
Lead Free Part Marking: http://www.linear.com/leadfree/

*The temperature grade is identified by a label on the shipping container. Consult LTC Marketing for parts specified with wider operating temperature ranges.

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range of –55°C to 85°C for M grade parts, –40°C to 85°C for I grade parts and 0°C to 70°C for C grade parts.

PARAMETER	CONDITIONS			LT1017 MIN	LT1017 TYP	LT1017 MAX	LT1018 MIN	LT1018 TYP	LT1018 MAX	UNITS
Offset Voltage (Note 2)	±0.75V ≤ V_S ≤ ±20V		25°C		0.4	1		0.4	1	mV
			●		0.5	1.4		0.5	1.4	mV
			125°C			5		0.7	1.5	mV
Bias Current	±0.75V ≤ V_S ≤ ±20V		25°C		5	15		15	75	nA
			●		7	25		18	100	nA
			125°C		10	60			110	nA
Offset Current	±0.75V ≤ V_S ≤ ±20V		25°C		0.4	2		1	8	nA
			●		0.5	3		1.6	12	nA
			125°C			20			20	nA
Common Mode Rejection Ratio	V_S = ±20V, –20V ≤ V_{CM} ≤ 19.1V		25°C	105	115		105	115		dB
			●	100	115		100	115		dB
			125°C	82	100		95	110		dB
Power Supply Rejection Ratio	±0.75V ≤ V_S ≤ ±20V		25°C	96	110		96	110		dB
			●	95	105		95	105		dB
			125°C	82			86	100		dB
Gain	No Load, V_{OUT} = ±19.9V (Note 3)		25°C	110	115		110	125		dB
			●	105	115		105	120		dB
			125°C	100			100			dB
	R_L = 4k, V_{OUT} = ±19V		25°C	100	110		100	110		dB
			●	94			94			dB
Output Sink Current	V^+ = 4.5V, V^- = 0V		25°C	30	65		35	70		mA
	Overdrive > 30mV		●	25	50		25	50		mA
			125°C	10	20		10	30		mA
Output Source Current	V^+ = 40V, V^- = 0V		25°C	30	75		75	250		µA
	V_{IN} = 5mV, V_{OUT} = 0.4V		●	25	70		50	220		µA
			125°C	25	75		50	200		µA
	V^+ = 1.2V, V^- = 0V		25°C	25	35		70	140		µA
	V_{IN} = 5mV, V_{OUT} = 0.4V		●	15	20		45	120		µA
			125°C	25	40		40	110		µA
Negative Output Saturation	I_{OUT} = 0mA	V^+ = 4.5V, V^- = 0V	25°C		5	20		5	15	mV
	= 0.1mA	V_{IN} = –10mV	25°C		35	60		35	60	mV
	= 1mA		25°C		60	120		60	120	mV
	= 10mA		25°C		120	200		120	250	mV
	= 30mA		25°C		350	600		350	700	mV
	I_{OUT} = 0mA	V^+ = 4.5V, V^- = 0V	●		5	20		8	20	mV
	= 0.1mA	V_{IN} = –10mV	●		40	75		35	70	mV
	= 1mA		●		75	150		70	150	mV
	= 10mA		●		150	300		150	300	mV
	= 30mA		●		600	900		500	900	mV
	I_{OUT} = 0mA	V^+ = 4.5V, V^- = 0V	125°C		25	50		10	40	mV
	= 0.1mA	V_{IN} = –10mV	125°C		60	100		60	100	mV
	= 1mA		125°C		100	200		110	200	mV
	= 10mA		125°C		300	600		300	400	mV
	= 30mA		125°C					900		mV
Positive Output Saturation	I_{OUT} = 0µA		25°C		40	80		35	80	mV
	= 10µA		25°C		175	250		175	250	mV
	= 0µA		●		45	90		45	90	mV
	= 10µA		●		190	300		190	300	mV
	= 0µA		125°C		50	100		50	100	mV
	= 10µA		125°C			300			300	mV

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range of –55°C to 85°C for M grade parts, –40°C to 85°C for I grade parts and 0°C to 70°C for C grade parts.

PARAMETER	CONDITIONS		LT1017 MIN	LT1017 TYP	LT1017 MAX	LT1018 MIN	LT1018 TYP	LT1018 MAX	UNITS
Leakage Current	V_S = 5V, V_{OUT} = 40V V_{IN} ≥ 100mV	25°C		0.5	3		1	8	μA
		●		0.6	3		1.8	10	μA
		125°C			5			15	μA
Supply Current	V_S = 5V	25°C		30	60		110	250	μA
		●		40	80		110	250	μA
		125°C			80			300	μA
	V_S = 40V	25°C		40	90		130	250	μA
		●		55	100		140	270	μA
		125°C			100			300	μA
Minimum Operating Voltage	I_{OUT} = 1mA	25°C			1.15			1.2	V
		●			1.15			1.2	V
		125°C			1.15			1.2	V

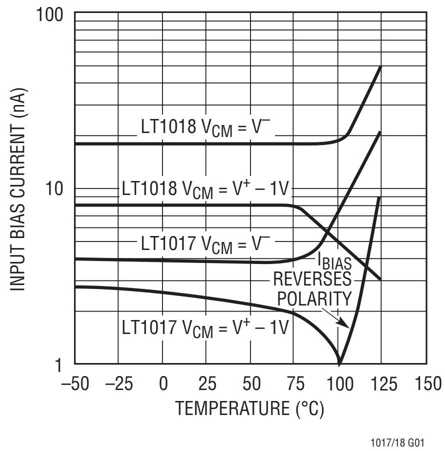
Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: Offset voltage is guaranteed over a common mode voltage range of $V^- \le V_{IN} \le (V^+ - 0.9V)$.

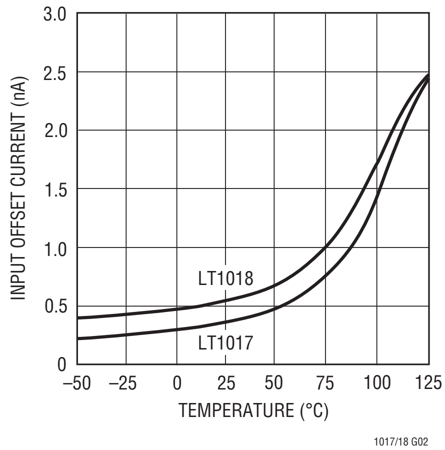
Note 3: No load gain is guaranteed but not tested (LT1017 only).

TYPICAL PERFORMANCE CHARACTERISTICS

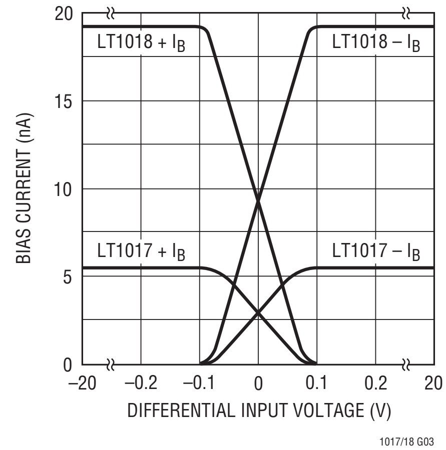
Input Bias Current



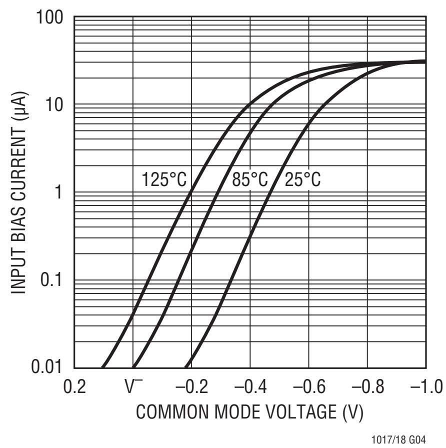
Input Offset Current



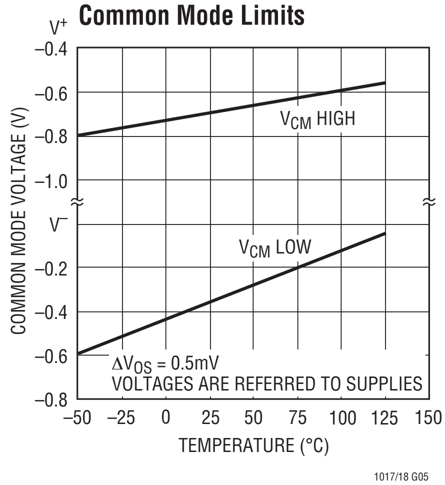
Bias Current vs Differential Input



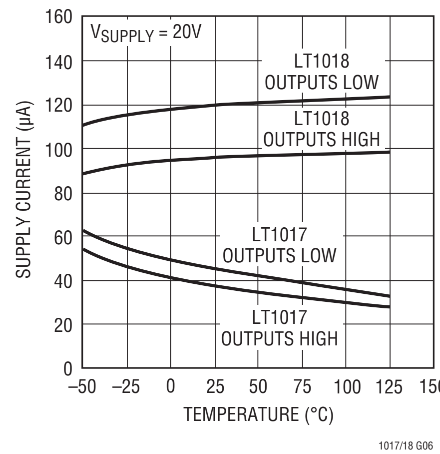
Input Bias Current with Inputs Driven Below the Supply



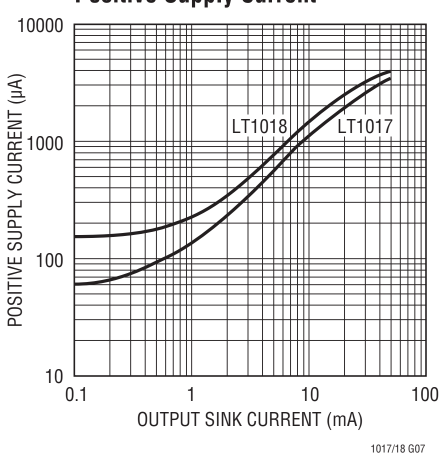
Common Mode Limits



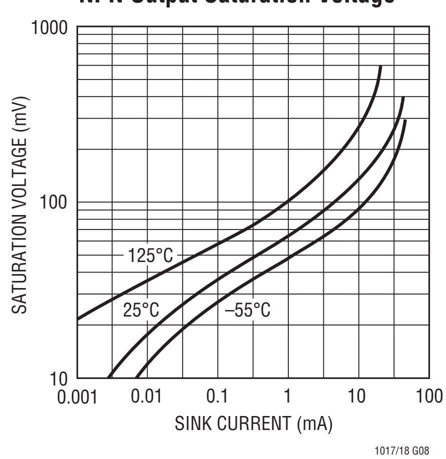
Supply Current



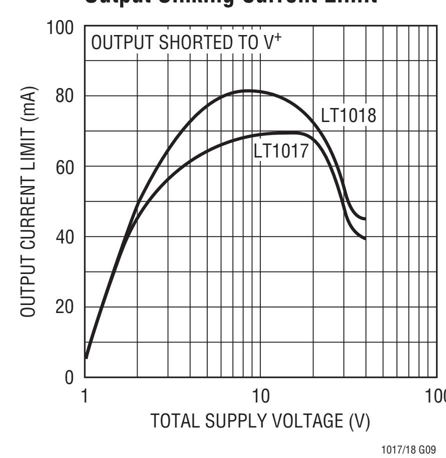
Positive Supply Current



NPN Output Saturation Voltage

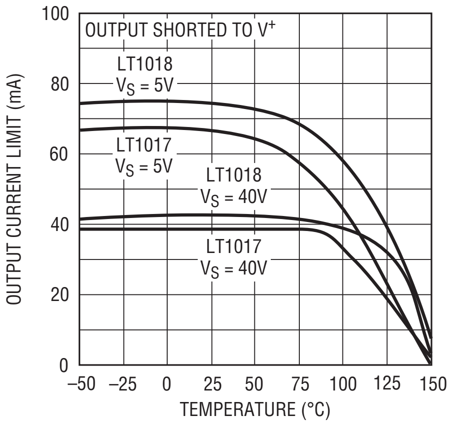


Output Sinking Current Limit



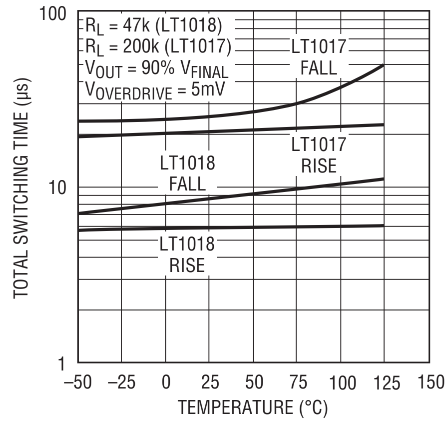
TYPICAL PERFORMANCE CHARACTERISTICS

Output Sinking Current Limit



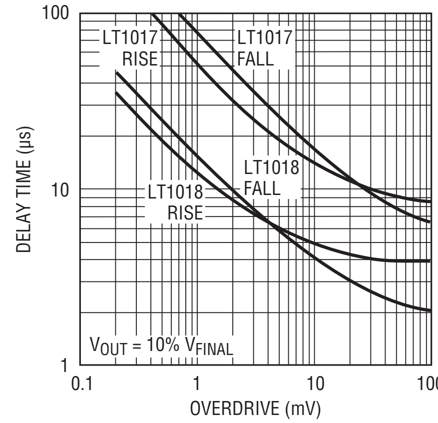
1017/18 G10

Total Switching Time



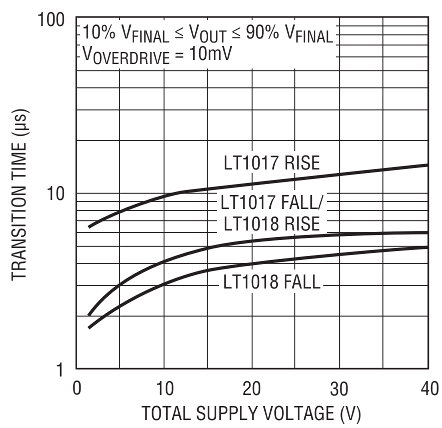
1017/18 G11

Output Delay



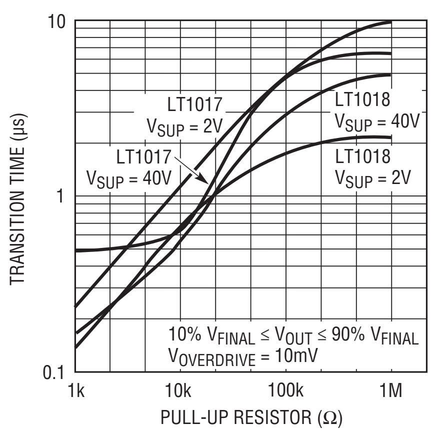
1017/18 G12

Transition Time



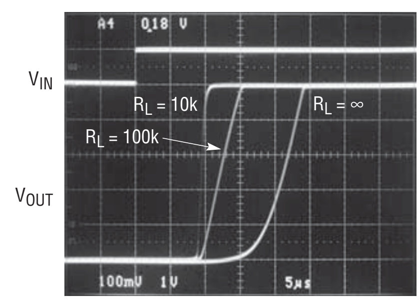
1017/18 G13

Positive Transition Time



1017/18 G14

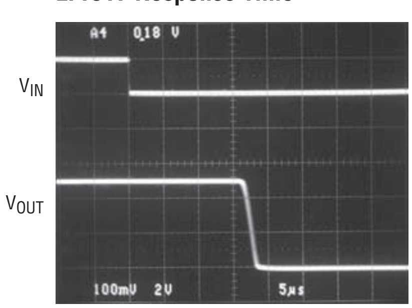
LT1017 Response Time



$V^+ = 5V$ 5µs/DIV
$V^- = 0V$
V_{IN} = 100mV STEP
$V_{OVERDRIVE}$ = 10mV

1017/18 G15

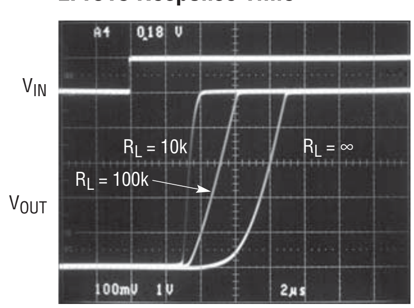
LT1017 Response Time



$V^+ = 5V$ 5µs/DIV
$V^- = 0V$
V_{IN} = –100mV STEP
$V_{OVERDRIVE}$ = –10mV

1017/18 G17

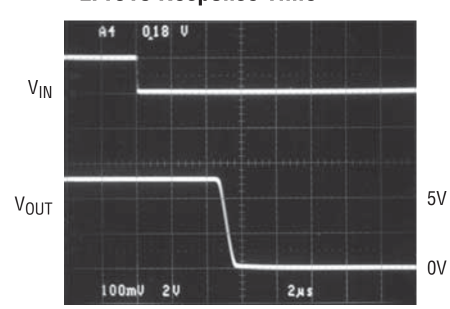
LT1018 Response Time



$V^+ = 5V$ 5µs/DIV
$V^- = 0V$
V_{IN} = 100mV STEP
$V_{OVERDRIVE}$ = –10mV

1017/18 G16

LT1018 Response Time

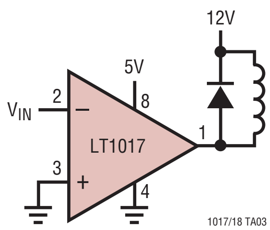


$V^+ = 5V$ 2µs/DIV
$V^- = 0V$
V_{IN} = –100mV STEP
$V_{OVERDRIVE}$ = –10mV

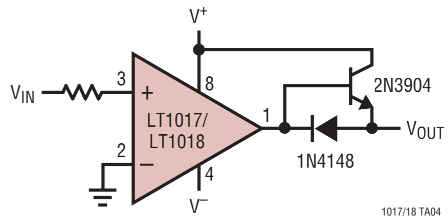
1017/18 G18

TYPICAL APPLICATIONS

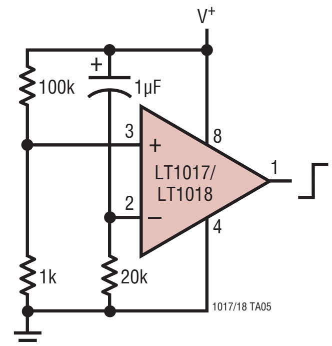
Driving Relays



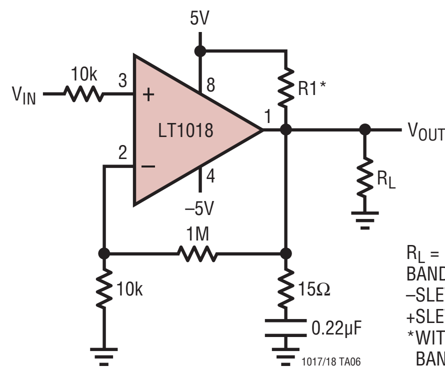
Increasing Positive Output Current



Delay On Power Up

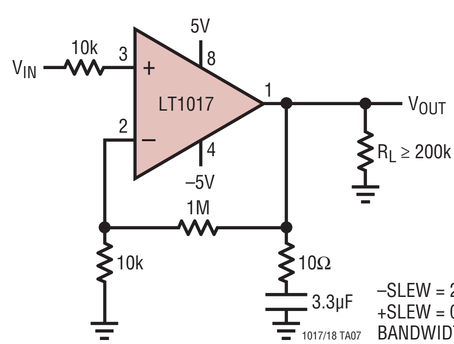


LT1018 Op Amp, $A_V = 100$



R_L = 100k
BANDWIDTH = 30Hz
–SLEW = 320V/ms
+SLEW = 0.93V/ms
*WITH R1 = 1k
BANDWIDTH ≅ 200Hz

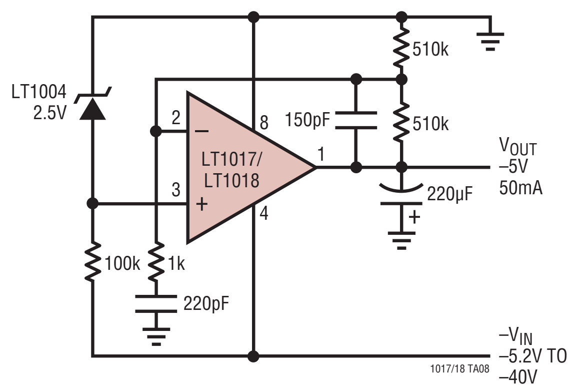
LT1017 Op Amp, $A_V = 100$



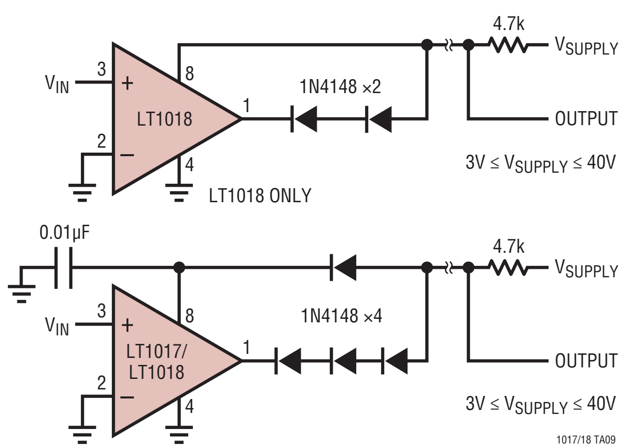
–SLEW = 23.5V/ms
+SLEW = 0.017V/ms
BANDWIDTH = 0.3Hz AT R_L = 220k

TYPICAL APPLICATIONS

Negative Voltage Regulator



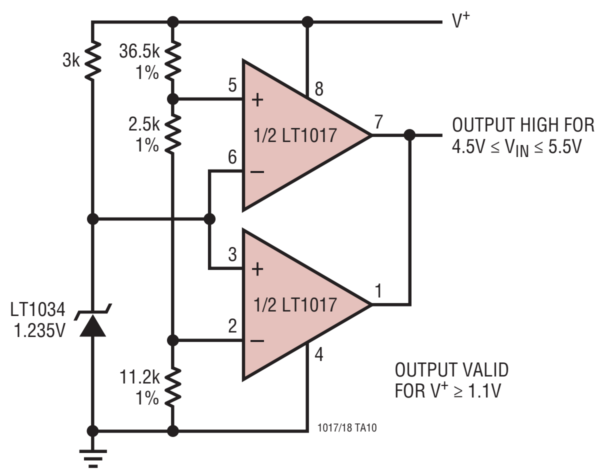
2-Wire Comparator



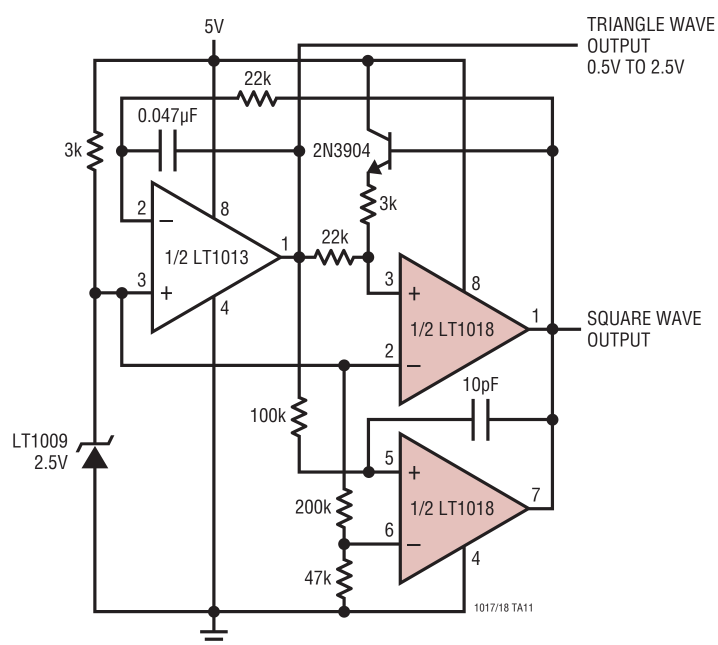
10178ff

TYPICAL APPLICATIONS

5V Power Supply Monitor

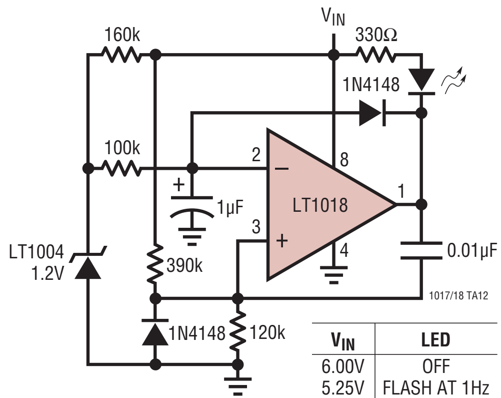


Precise Tri-Wave Generator



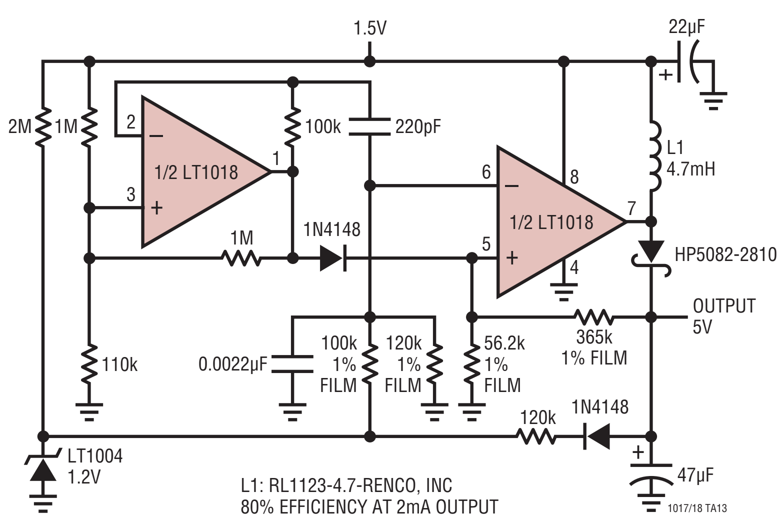
TYPICAL APPLICATIONS

Power Supply Monitor



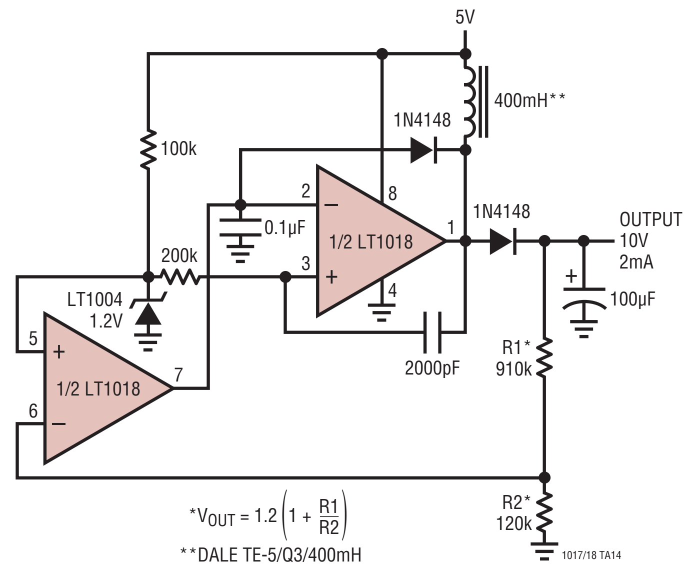
V_{IN}	LED
6.00V	OFF
5.25V	FLASH AT 1Hz
5.00V	FLASH AT 3Hz
4.75V	FLASH AT 5Hz

1.5V Input Flyback Regulator

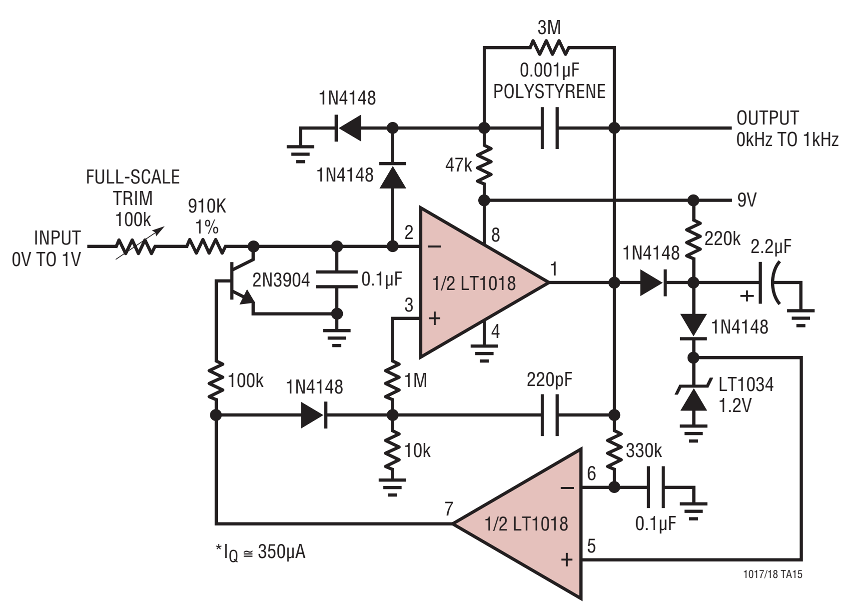


TYPICAL APPLICATIONS

Regulated Step-Up Converter

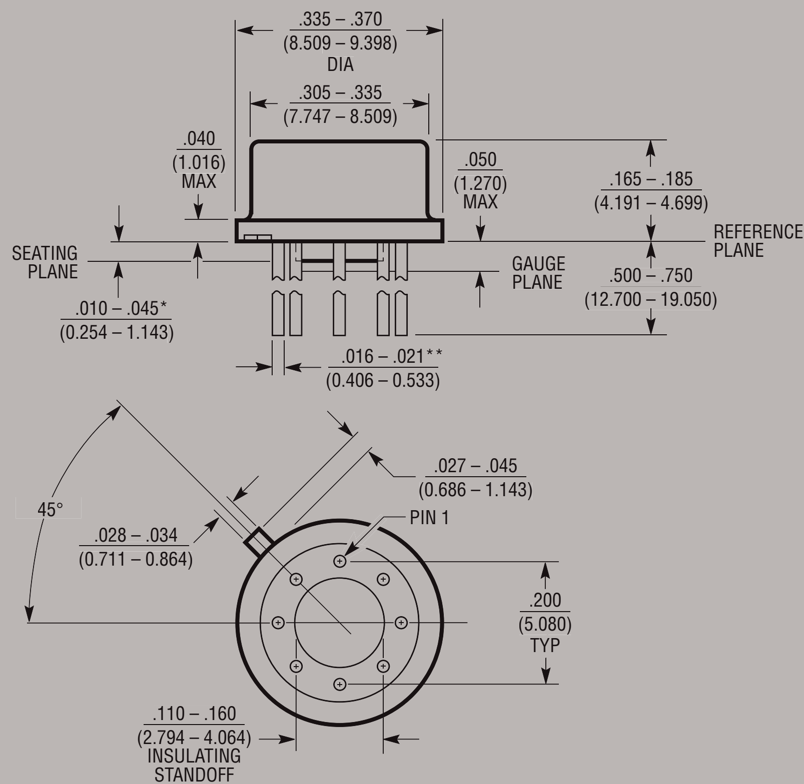


Low Power* V-to-F Converter



PACKAGE DESCRIPTION

H Package
8-Lead TO-5 Metal Can (.200 Inch PCD)
(Reference LTC DWG # 05-08-1320)



*LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND THE SEATING PLANE

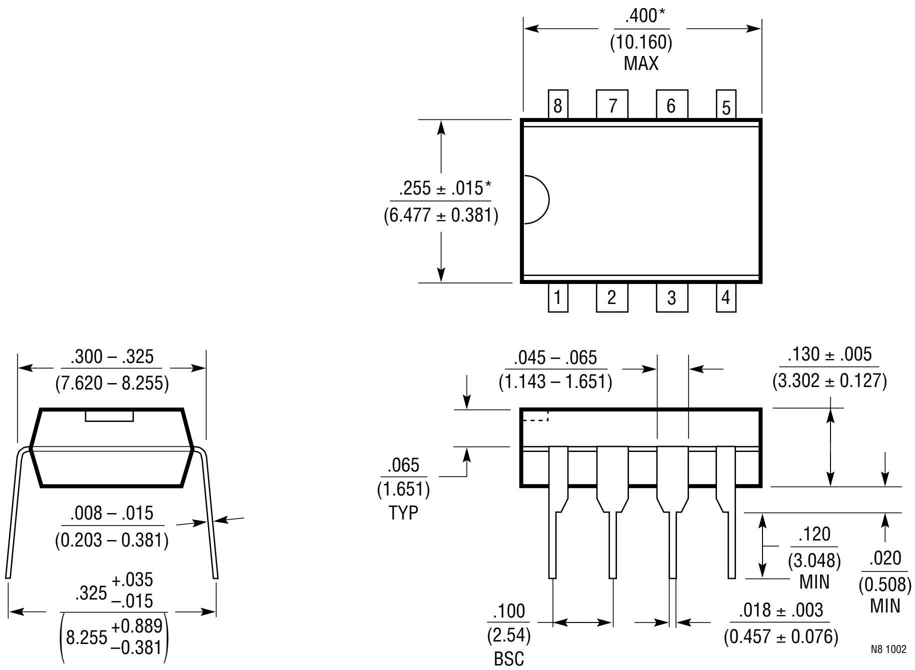
**FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS .016 – .024 (0.406 – 0.610)

H8(TO-5) 0.200 PCD 0204

OBSOLETE PACKAGE

PACKAGE DESCRIPTION

N8 Package
8-Lead PDIP (Narrow .300 Inch)
(Reference LTC DWG # 05-08-1510)

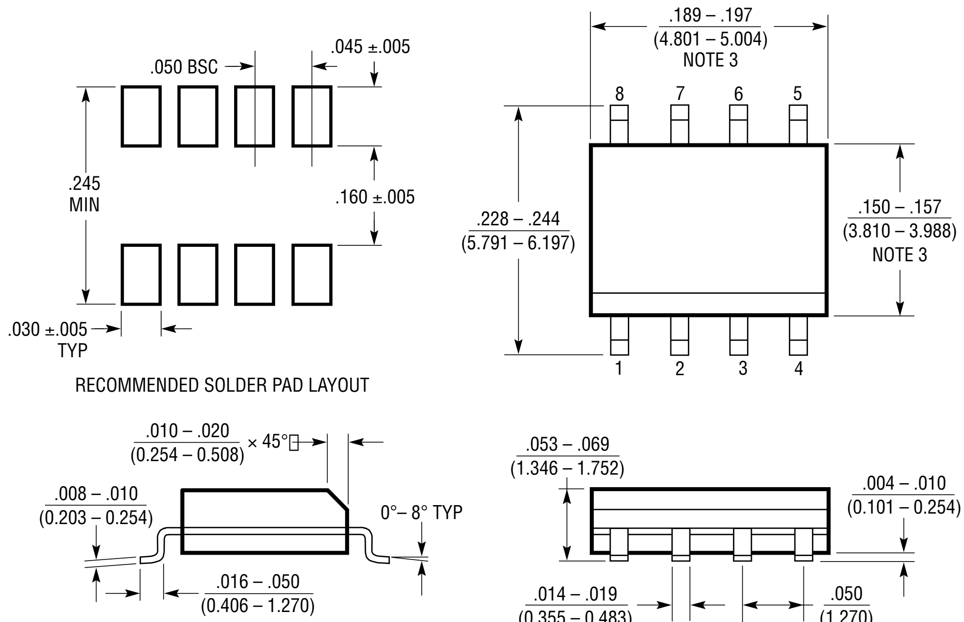


NOTE:
1. DIMENSIONS ARE $\frac{\text{INCHES}}{\text{MILLIMETERS}}$

*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

PACKAGE DESCRIPTION

S8 Package
8-Lead Plastic Small Outline (Narrow .150 Inch)
(Reference LTC DWG # 05-08-1610)

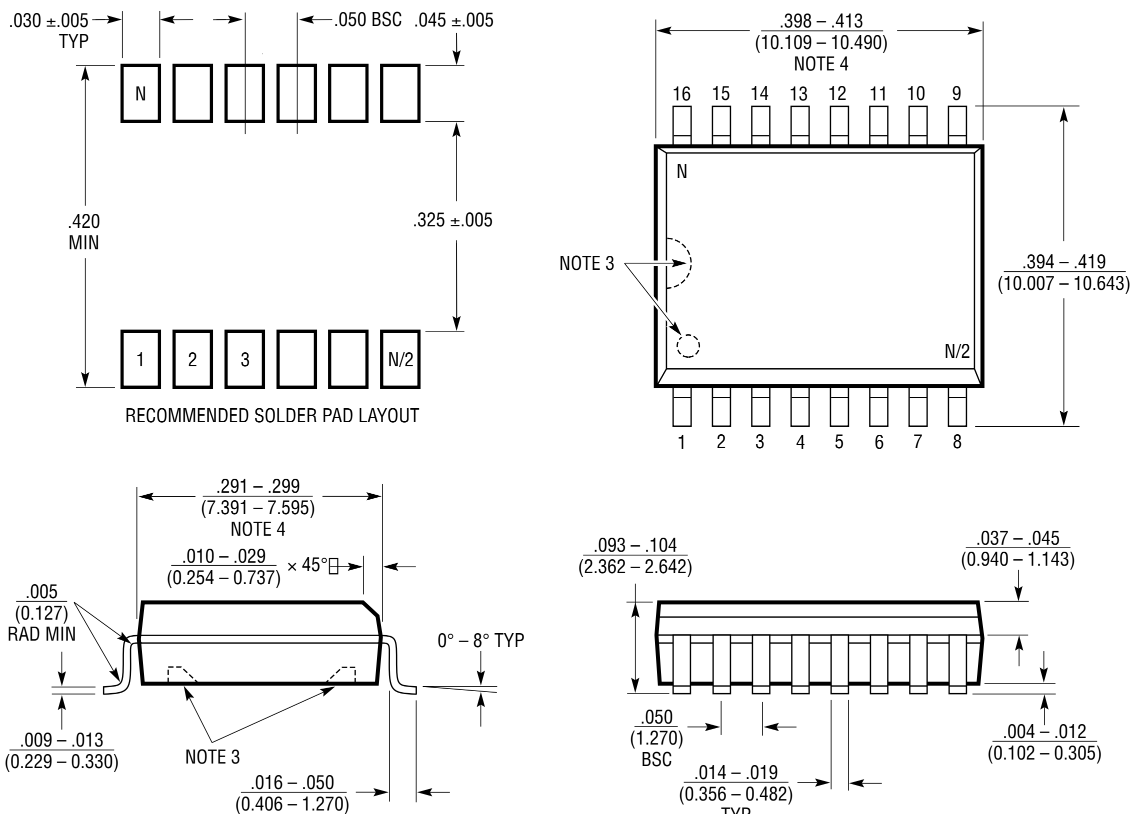


NOTE:
1. DIMENSIONS IN INCHES / (MILLIMETERS)
2. DRAWING NOT TO SCALE
3. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)

SO8 0303

PACKAGE DESCRIPTION

SW Package
16-Lead Plastic Small Outline (Wide .300 Inch)
(Reference LTC DWG # 05-08-1620)



NOTE:
1. DIMENSIONS IN $\frac{\text{INCHES}}{\text{(MILLIMETERS)}}$

S16 (WIDE) 0502

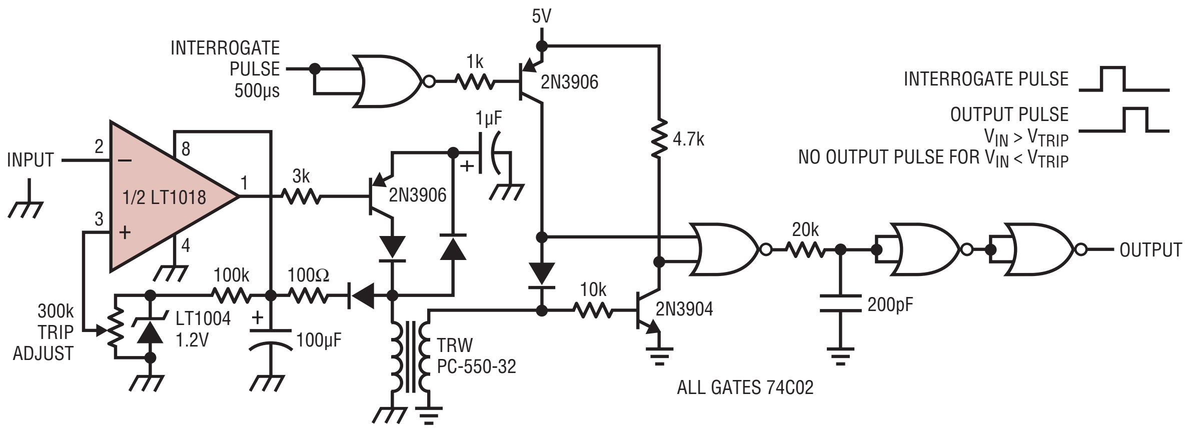
2. DRAWING NOT TO SCALE
3. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS
4. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)

LINEAR TECHNOLOGY

Information furnished by Linear Technology Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. Linear Technology Corporation makes no representation that the interconnection of its circuits as described herein will not infringe on existing patent rights.

TYPICAL APPLICATION

Fully Isolated Limit Comparator



RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1011/LT1011A	Voltage Comparators	Improved LT111A, 0.5mV $V_{OS(MAX)}$, 25nA $I_{B(MAX)}$, 3nA $I_{OS(MAX)}$, 250ns $t_{PD(MAX)}$
LT1020	Micropower Regulator and Comparator	40µA I_{SUPPLY}, 125mA I_{OUT}, 2.5V Reference Voltage
LTC1040	Dual Micropower Comparator	1.5µW (1Sample/Second), 0.5mV $V_{OS(MAX)}$, Rail-to-Rail Input
LT1120/LT1120A	Micropower Regulator with Comparator and Shutdown	20µA I_{SUPPLY}, 125mA I_{OUT}, 2.5V Reference Voltage
LT319A	Dual Comparators	0.5mV $V_{OS(MAX)}$, 25mA I_{OUT}, 80ns t_{PD}
LT1671	Single Supply Ground Sensing Comparator	450µA I_{SUPPLY}, 60ns t_{PD}, 0.8mV V_{OS}
LT1716	Micropower, 44V, SOT-23 Ground Sensing Comparator	Input Common Mode Range Extends from –5V to 44V from Negative Supply

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